Dilutions Worksheet

Name: ______KEY______

U7LM3B

1. When a solution of glucose, $C_6H_{12}O_6$, is diluted, the number of moles of the solute in the original solution is (greater than, less than, **the same as**) the number of moles of solute in the resulting less concentrated solution.

2. Calculate the *molarity* of the resulting solution if a certain volume of water was added to 50.0 mL of 2.10 M KOH solution to make a solution with a volume of 1.40 L.

   $M_1V_1 = M_2V_2$ ... solve for $M_2 = (M_1V_1) / V_2$ first if preferred

   (2.10 mol/L) (0.0500L) = M_2(1.40L)

   M_2 = 0.075 mol/L … 3 sig figs… **0.0750M**

3. Commercial concentrated hydrochloric acid is 12.0 M HCl. What *volume* of concentrated HCl is required to prepare 2.50 L of 2.20 M HCl solution?

   $M_1V_1 = M_2V_2$ ... solve for $V_2 = (M_1V_1) / M_2$

   (12.0 M) (V_1) = (2.20 M)(2.50L)

   V_1 = 0.458333 L … 3 sig figs… 0.458L or **458mL**

4. A 250. mL of a sodium hydroxide solution is diluted to 825 mL with water to form a 0.80 M solution. What was the molarity of the original solution?

   M_1(250mL) = (0.80M)(825mL)

   M_1 = 2.640 M … 2 sig figs… **2.6 M**

5. A lab technician needs one liter of 0.250 M HCl. However, in her lab, there is only 2.0 M HCl solution available. Describe what the lab technician will do.

   The lab tech should first calculate what volume of concentrated solution she will need.

   (2.0 M)(V_1) = (0.250 M)(1 L)

   V1 = 0.125L = 125mL…

   Only two significant figures actually matter, but the lab tech should be as precise as possible in measureing 125mL of the original solution in a clean, dry graduated cylinder. She should pour this solution into a 1.0L volumetric flask containing ~500mL of distilled/deionized water. She can then rinse the graduated cylinder two to three times with distilled/deionized water, carefully adding the 'rinse water' into the larger 1L volumetric to help carry all solute over into the new container. She can then fill the 1.0L volumetric to the marking, cap, and mix thoroughly.

6. Calculate the *molarity* of a solution prepared by mixing 50.0 mL of 0.250 M Na_2SO_4 and 100. mL of 0.125 M Na_2SO_4 solution.

   This situation is slightly more complicated than the usual $M_1V_1=M_2V_2$ dilution scenario because there are *two* concentrated solutions to begin with. In this case, dimensional analysis is probably more useful for considering the total moles added and the total final volume.

   $$\frac{[(0.250\ mol/L)(0.050L) + (0.125\ mol/L)(0.100L)]}{(0.050L + 0.100L)} = \frac{\text{total moles } Na_2SO_4}{\text{total soln volume}} = \frac{(0.0125mol + 0.0125mol)}{0.150\ L}$$

   = 0.166667 M… 3 sig figs… **0.167M Na_2SO_4**